his child vaccinated, but this law is regularly set at defiance. Besides this, even if boards of guardians and vestries are disposed to carry it out, they have no means of finding out unvaccinated children. There is, it is true, the Registration Act, but that Act does not make registration compulsory, and in some districts of London it has been stated that twenty-five per cent. of the population are not registered. There is no machinery yet set on foot to enable the inspectors of vaccination to lay hold of these children. Then there is the emigration of families from one parish to another. There is no plan of action for discovering these unvaccinated children in these families. It is vain for one parish to look after its vaccination, if other parishes do not. This is an Imperial question, and ought not to be left to Boards of Guardians.

But what can we do at once, so as, if possible, to avert the further course of the epidemic? We can hardly hope, from past experience, that the epidemic will cease at present, if nothing further be done. The measures which a knowledge of the nature of the disease would suggest are as follows:

1. There should be a vigorous attempt made at once to secure the vaccination and re-vaccination of all persons who have not yet undergone these operations. It is of no use to wait till such persons seek this for themselves. They must be found out, and found out at once. At the rate at which inspectors are now finding out the unvaccinated, the epidemic will have spent its force, and little, if any, life will be saved. But if the Legislature would at once interfere, and insist on a house-to-house visitation with a body of men armed with vaccine virus, and ability and power to vaccinate, the whole of London might be visited, and every inhabitant inspected or vaccinated, in the course of the next month. These agents must be medical men or medical students, who should be paid so much a day for their trouble. It is this question of paying that constantly hampers vestries and boards of guardians. They would rather see any number of people sick than pay to prevent their sickness. The Government must do it, and do it at once, or it will not be done at all. A few hundreds of pounds will do it, and it will save thousands that the small-pox would cost.

2. Vigorous efforts should be made to stamp out each case of small-pox where it occurs. Every case of the disease should be reported to the sanitary authority of the district, on pain of fine and imprisonment. The person affected should be either removed to a hospital or isolated. If the latter, the isolation should be complete. Satisfactory evidence of the isolation should be given to the medical officer of health, and unless he is satisfied with the means taken, some method of punishing the erring parties should be devised. Contagious diseases of all kinds may be thus arrested. It is the difficulty of discovering the first cases that makes the spread of contagious disease so rapid and extensive.

3. Disinfection should be insisted on. This subject requires more thought and attention than it has yet received. All possible means by which the poison can be conveyed from one person to another should be prevented. The poison of small-pox retains its vivaciousness or reproductive power more tenaciously, apparently, than any other animal poison. It can be conveyed in clothes, paper, thread, string, everything that it is possible to use in the sick room. The doctor may take it to his patients, the lawyer to his clients, or the clergyman to his congregation if he has been visiting the sick. The Levitical laws against leprosy would be hardly too severe to prevent the spread of small-pox. Rules of the most stringent kind ought to be laid down for the guidance of nurses and all persons entering the sick room. Above all, in every district where small-pox prevails, there should be a disinfecting apparatus. This should be an oven not heated by gas, but by a stove. The oven should be long enough to receive beds and all kinds of bed-clothes and wearing apparel. These things should be conveyed to the store in a covered van, which could at once be placed in the oven without opening it to remove its contents. Filthy rags and beds of straw and shavings should be burned in the stove. Such an apparatus is at present at work in the parish of St. Giles. It should be forthwith erected in every district in London. Even when the small-pox has killed its utmost, such ovens will be useful for a future war with the demon of contagion in some other form.

Will some philanthropic member of the House of Commons draw up a Bill embracing these suggestions, and get it passed into law as quickly as possible, so as to save the lives of some thousands of our population, and the faces and purses of many thousands more?

E. LANKESTER

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## *GÜNTHER'S CATALOGUE OF FISHES*

*Catalogue of Fishes in the British Museum.* By Albert Günther, M.A., M.D., LL.D., F.R.S., F.Z.S., &c. Eight volumes. (London, 1859-1870.)

THE recent issue of the eighth and last volume of Dr. Günther's Catalogue of Fishes brings to a completion one of the most laborious and important zoological works of the present epoch. For Dr. Günther's Catalogue is not a mere catalogue in the ordinary sense of the word, but rather a more or less complete history of all the known members of the class of fishes. Not merely the higher divisions of the class, but the genera and species are all fully characterised, and to each species is appended a list of the specimens of it contained in the British Museum. References to other species, either doubtful or not yet acquired by the national collection, are also added. When it is stated that our national collection of fishes now contains 29,275 specimens, some idea may be formed of the labour that has been involved in naming, arranging, cataloguing, and describing such a vast mass of materials. Each of these specimens has to be carefully examined, in many cases internally as well as externally, and to be compared with its brethren of the same and allied species, before it can be satisfactorily determined. Let our readers go through this process in the case of one fish, and they will be able to form some sort of idea of the amount of toil involved in repeating this experiment some thirty thousand times over. Dr. Günther has in fact expended about thirteen years of unremitting labour on this great work, and has had the good fortune to bring it to a felicitous conclusion. No general account of fishes has been published since Lacépede and Schneider's edition of Bloch about the beginning of the present century, as the celebrated "Histoire Naturelle des

Poissons" of Cuvier and Valenciennes, like too many other French publications, has never been finished.

When Dr. Günther commenced his labours in 1859, his work was apparently intended to be confined to the Acanthopterygian order of fishes, and the volumes were entitled accordingly. On the completion of this great order with the third volume in 1861, the scope and title of the publication were extended so as to embrace the whole class of fishes. The fourth volume, issued in 1862, was devoted to the Pharyngognathi and Anacanthini of Müller, whose system Dr. Günther has generally followed. Here, however, he has made a slight change in the nomenclature used by the great German Anatomist, considering that the structure of the fins is of more importance than that of the pharyngeal bones, and therefore changing Müller's name, "Pharyngognathi acanthopteri" into "Acanthopterygii pharyngognathi.' '

In the fifth volume of his work, issued in 1864, Dr. Günther commenced the order Physostomi, treating first of the Siluroids and allied forms, which were formerly associated with the Salmonidæ; in the sixth, published two years later, the Salmonidæ themselves were handled. This group, Dr. Günther informs us, both on its own account and from the large amount of literature involved in its investigation, offers such great difficulties to the ichthyologist, that "as much patience and time are required for the investigation of a single species of it as in the case of other fishes for that of a whole family." The ordinary method followed by naturalists in distinguishing and determining species is here utterly inadequate; and Dr. Günther does not hesitate to assert that "no one, however experienced in the study of other families of fishes, will be able to find his way through this labyrinth of variations without long preliminary study, and without a good collection for constant comparison. Sometimes forms are met with so peculiarly and so constantly characterised, that no ichthyologist who has seen them will deny them specific rank; but in numerous other cases one is much tempted to ask whether we have not to deal with a family which, being one of the most recent creation, is composed of forms not yet specifically differentiated."

Dr. Günther's preliminary remarks (vol. vii. p. 3), before he commences the discussion of the true *Salmones*, well merit perusal by any naturalist engaged on the differentiation of species. In the Salmonidæ, characters such as the proportion of one part of the body to another, and the number of fin-rays, which in other groups of fishes are generally employed for the separation of species, fail entirely, and another set of characters has to be relied upon. To add to the confusion, some of the species at least *interbreed*, and "it is probable, although at present not yet confirmed by direct observation, that such hybrids mix again with one of the parent species, thereby producing an offspring more or less similar to the pure breed." The difficulties thus added to the correct determination of the Salmonidæ, may be easily understood.

The seventh volume of Dr. Günther's work, published in 1868, continues the history of the order Physostomi, and is devoted mainly to the extensive families Cyprinidæ and Clupeidæ, and to smaller groups nearly allied to them. In the eighth and last volume, published last year, Dr. Günther concludes the Physostomi with the eels and their allies, and then treats of the Lophobranchii and Plectognathi, which form the two last orders of the Teleostian subclass of fishes. The small subclass *Dipnoi*, embracing only the two Lepidosirens, comes next, and to them is appended a short notice of the recent discovery of the new Australian Mud-fish, which Mr. Krefft has referred to the Agassizian genus *Ceratodus*.* Dr. Günther states his inability at that period to determine whether it "should be referred to the Dipnoans or to the Ganoids, or should form the type of a separate subclass." But it is well known that he has since received perfect examples of this wonderful fish, and has in preparation a memoir which will, no doubt, put at rest all questions upon its structure and its position in the natural series.

The Ganoids (of which, formerly multitudinous, subclass Dr. Günther only recognises *six* existing species) and the Chondropterygians, or Sharks and Rays, follow next in order, and the eighth volume concludes with the two undoubtedly lowest forms of the class of fishes—the Lampreys and the Lancelet, an *invertebrated* vertebrate.

The total number of specimens of fishes in the collection of the British Museum at the period of the close of this great work was, as we have already said, 29,275. These are referred by Dr. Günther to 5,177 species. Besides these, 1,666 other species are recognised as valid, of which the national collection has not yet obtained examples, and 1,682 more are referred to as doubtful. "Assuming, then," says Dr. Günther, "that about one half of the latter will ultimately be admitted into the system, and that since the publication of the volumes of this work, about 1000 species have been described elsewhere, we may put the total "number of fishes at present known as about 9000."

In the preface to the last volume, Dr. Günther, besides giving us a general *résumé* of the extent of the collection under his charge, enters very fully into several other questions which are well worthy of attention, particularly at the present moment, when the relations between Government and Science are undergoing investigation by a Royal Commission. Whilst expeditions, fitted out by Austria, Prussia, and Italy, are despatched round the globe, accompanied by a staff of naturalists, and bringing back large collections of fishes to the national museums, our navy, it appears, is almost inert on this subject. Except from the Magellan Straits Surveying Expedition, to which Dr. Cunningham was attached as naturalist, no contribution from our Admiralty, which has so many ships always afloat, has reached the ichthyological department of the British Museum of late years. Yet it cannot be doubted that a very few words of encouragement from my Lords of the Admiralty would induce some of the many naval officers whose time must hang heavy on their hands at foreign stations, to turn their attention to collecting the common objects of the element on which they pass their lives. We assume, of course, that the expense of attaching a competent naturalist to any foreign expedition would be so great that "*my Lords would not feel justified in incurring it!*" Yet even the economical government of the United States thinks differently, and "each exploring American expedition was and still is accompanied by collectors, employed solely for the benefit of public museums."

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* See NATURE, vol. ii. p. 106.

We should also, did not space fail us, like to call special attention to Dr. Günther's remarks on the importance of the study of the class of pikes as regards the elucidation of some of the most perplexing problems of Biology. "No other class of vertebrates," says our author, "is of equal importance to the geologist and palæontologist: the materials for comparing the living with past creations being so numerous and so diversified that we cannot help thinking that the relation of the various epochs to one another will be solved in the fields of ichthyology. Although fishes are mostly hidden by the elements in which they live, so that the knife of the anatomist generally first reveals new facts connected with their life, we have sufficient evidence to show that the phenomena of life are more varied in their different groups than in any other of the higher vertebrata, and that their study will form a solid basis for the solution of those general biological questions which, perhaps rather prematurely, agitate the minds of many zoologists."

## OUR BOOK SHELF

*On the Relations between Chemical Change, Heat, and Force.* By the Rev. H. Highton, M.A.

WE should not have noticed this paper, though it has been sent to us for review, had it not been marked as "Reprinted from the *Quarterly Journal of Science*." This is its sole claim on our attention.

To put the contents in their simplest form before the reader, we may at once say that the Rev. Mr. Highton is a Perpetual-motionist. Not, perhaps, consciously—rather the reverse—but he belongs *in fact* to that singular class, though he would probably deny the charge with indignation. A short extract or two will, however, be sufficient to prove it to the satisfaction of any one acquainted with modern physics. Take the following:—

"Does there not, then, exist a power in nature for force to multiply force—even in the same way as life is multiplied by life through successive generations, and one living being may in due time become a thousand without losing its own vital energy?"

"We cannot . . . . produce heat without at the same time producing virtually in some shape or other an equivalent of cold."

"Cannot skill, mere skill, produce a less or greater disturbance and restoration of equilibrium, and so more or less force?"

If these extracts, which are perhaps not the richest which a careful search may discover, be not sufficient for the reader's amusement, we refer him to the original work. If they be not sufficient to prove to him the justice of our remarks, we refer him at once to some good scientific text-book, for he will have amply proved his need of instruction.

It would be an insult to our instructed readers to suppose that the fallacies of this paper require to be exposed *seriatim* for their benefit. *Ex uno disce omnes.* One will be given presently. But before giving it, we must strongly protest against the way in which many of the early, and some even of the later, discoveries of Joule are ignored throughout, while the attempts made to verify them by inferior experimenters, are put forth as original researches. When, however, Joule *does* happen to be referred to, the description of his experiments is wonderful indeed. Here is an example:

"He (Joule) churned various liquids in a calorimeter, and measured the increase of temperature. But in this kind of motion, as, perhaps, in all cases of friction, there is a pulling exertion of force, as well as one of pushing. Behind the arms of the paddle-wheel in the churn the liquid is pulled, and is pushed before them."

Comment on this sort of thing would be thrown away. When men like Helmholtz, Rankine, and Thomson vouch for the accuracy of a proposition, the world may well be indifferent to the criticisms of a Heath or a Highton. The grand founders of a rapidly progressing science cannot turn aside from their labours to answer frivolous objections. And it is strange and sad, indeed, that such excellent journals as the *Philosophical Magazine*, the *Quarterly Journal of Science*, and the *Chemical News* should diminish the space at their disposal for facts, by affording facilities for the dissemination of palpable nonsense and error.

As regards Electro-dynamics, Mr. Highton follows in the track of several better-known men, and is thus to a certain extent relatively excusable for his blunders, though they are quite as grave as those he commits with reference to the general theory of Conservation of Energy. The subject is by no means a very easy one, and it would certainly be somewhat hard to explain in a thoroughly popular manner the causes of his error. His difficulties, however (so far as we have had patience to investigate them), are such as have been met and overcome long ago by Joule, Faraday, and Thomson. (See, especially, Thomson, *British Association Reports*, 1852.) They are due, in great part, to his having confined his attention to the *zinc* alone of a galvanic cell.

*Our Feathered Companions.* Conversations of a Father with his Children about Sea birds, Song birds, and other feathered tribes that live in or visit the British Isles, their habits, &c. By the Rev. Thomas Jackson, M.A. (London: S. W. Partridge and Co.)

*Dogs and their Doings.* By the Rev. F. O. Morris, B.A. (London: S. W. Partridge and Co.)

THE first of the books of which we give the titles above, is one we cannot take up without pleasure, because of the memories that its numerous illustrations bring to those who are shut up amongst bricks and mortar, of some wild sea-shore, sweet and tender woodland, or moor with gorse and fern; all of which are the homes of birds who would rather be free from the companionship of man than seek it, and which we love all the more for their wild freedom. "Our Feathered Companions" is full of information about birds, telling many well-known things about their habits and lives, of which children will never tire as long as there are children. With regard to the children in this book, we wish our author had drawn them from nature; we do not often meet with little boys who quote Greek out of school, and should be sorry if little girls were always moralising about birds being useful to man; we cannot read the narrative without feeling that their lives must have some other purpose beyond this, and we are glad that our children should be reminded by some of the little poems in the book, that they should love birds for their beauty, and learn all they can about them, rather than kill them to gratify a selfish desire for possession. The pictures of sea-birds are almost all charming, and there are many more of our favourite birds which, with a few exceptions, are very good.

"Dogs and their Doings" appears to be rather a compilation of old stories of wonderfully wise and clever dogs than the result of fresh observation,—the most extraordinary is of one which could pronounce words, and of another which understood the use of money; there are others which show wonderful affection and faithful memory for years after death. The book will be intensely interesting to children who love animals, they will recognise the tricks and sagacity of some of their friends in the dogs described; for dogs who know Sunday, and show great evidence of memory and reasoning powers, are to be met